REMARKS

Applicant respectfully requests reconsideration of this application, as amended, and consideration of the following remarks. Claims 1, 6, 7, 8, 13 and 14 have been amended. Claims 1-15 remain pending. Claims 1-14 stand rejected as being unpatentable under 35 U.S.C. 103(a).

Amendments

Amendments to the Claims

Applicant has amended the claims to more particularly point out what Applicant regards as the invention, i.e., a method for detecting an endpoint to a ***main*** etch process of a layer ***before breakthrough to an underlying material***. No new matter has been added as a result of these amendments.

Rejections

Rejections under 35 U.S.C. §103(a)

Claims 1-14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Litvak (US 5,499,733, hereinafter the Litvak reference) in view of Chao et al (US 5,780,315, hereinafter the Chao reference). Applicant respectfully traverses the rejection as neither the Litvak reference, nor the Chao reference either alone or in combination teach or suggest a method of detecting an endpoint of a main etch process as claimed herein.

The Chao reference discloses a system and a method for detecting an intensity drop-off of a wavelength of light emitted by the plasma. Specifically, "in a plasma chamber, a species within the plasma is monitored by detecting the ***emission*** of light in a limited wavelength band that shows material is being removed from the layer being etched. The detection signal drops off at breakthrough and this change that occurs at

breakthrough is detectable and useful as an endpoint indicator." emphasis added (col. 1, ln 51-57)

The Chao reference further discloses, "Etching during the main etch step is monitored by measuring light ***emission*** from the plasma, 8, in a limited wavelength band between about 360 to 400 nm, using light detection device, 9, and endpoint is detected when the measured light intensity falls to a prescribed level in relationship to the maximum intensity observed during the main etch step." emphasis added (col 5, ln 3-8)

It should also be pointed out that the Chao reference dealt with etching layers of conductive materials: "The method can be used for etching patterns in doped polysilicon, aluminum, aluminum-copper, aluminum-copper-silicon, tungsten, and other conductive layers used in the manufacture of semiconductor circuit devices." (col 4, ln 6-10)

While the Chao reference does teach ***an*** endpoint detecting method that is *loosely based on* a maximum of an intensity of a wavelength, the Chao reference does not teach an actual measurement of the maximum on the intensity but rather only a detection of a drop off in the intensity of the wavelength. Nor does the Chao reference teach detecting a maximum of an intensity of one or more wavelengths that are ***reflected directly*** *from the layer being etched*, in stark contrast to Chao's wavelength that is emitted from the plasma that has etched away a portion of the layer being etched or more precisely has broken through the layer being etched.

The Litvak reference teaches a method for detecting an end point of an etch process when the layer being etched has been removed to expose and begin etching a material that underlies the layer being etched (i.e., when breakthrough occurs). The Litvak reference further teaches that the light "is directed ***through the substrate*** of the article being processed (e.g., from the backside of a wafer being etched) reflected off the layer being processed and then directed back through the substrate before being detected. In this way, ***the beam avoids having to pass through any mist, fog or liquid layer that exists on the side of the substrate carrying the layer*** being processed." emphasis added

(col 3, ln 46-52). See also "Indeed, in actual practice, there may be many more reflections than shown in the simplified case of FIGS. 3 and 4. This is because there may be additional layers between the substrate and the top layer being processed. ***The method being described is suitable only, of course, if these intermediate layers are sufficiently transparent to the radiation to allow a signal to be reflected from the top layer and out of the bottom of the article***." emphasis added (Col 8 ln 63-67)

The Litvak reference does teach or suggest "directing radiant energy at two or more wavelengths directly onto a layer to be etched" because the Litvak reference specifically teaches away from "directing radiant energy ... directly onto a layer to be etched" as the Litvak reference teaches that light is "directed ***through the substrate*** of the article being processed ... In this way, ***the beam avoids having to pass through any mist, fog or liquid layer that exists on the side of the substrate carrying the layer***.

The Litvak reference further does not read on Applicant's "main etch" as stated by the Examiner because, Litvak does not teach or suggest that ***the sequence*** of a maximum of a first reflected wavelength ***followed by*** a maximum of a second reflected wavelength can indicate an ever thinner layer being etched ***without*** breaking through to a material that underlies the layer being etched.

The cited references illustrate that the importance of this ***sequence of maximums*** was ***neither known nor obvious*** to those skilled in the art or the importance the sequence of maximums would have been specifically described. Further, as stated by the Applicant, the advantage provided by detecting ***the sequence of maximums*** (i.e., a more accurate main etch endpoint thereby allowing a shorter finish etch process and a faster total etch process including the main etch and the finish etch) is also not described by the cited references.

Further, there is no suggestion to combine the cited references as described by the Examiner as the light sources are so dissimilar. The Litvak reference is in the field of CMP processing including shining a light into the back-side of a substrate to determine an

endpoint where the Chao reference is a plasma etch process that monitors the light emitted from the plasma to determine an endpoint. Further, both of the cited light sources quite diverse and indirect indications of what is occurring on the surface of the substrate being processed. Therefore it would not have been obvious to combine the two references as described by the Examiner.

As to claim(s) 1 and 8, neither the Litvak reference, nor the Chao reference, either alone or in combination disclose or suggest using a precise sequence of two or more intensity maximums of two or more different wavelengths that are reflected from the layer actually being etched can accurately detect a main etch process endpoint without break-through to the underlying layer.

Accordingly, Applicant respectfully submits that Applicant's invention as claimed in claims 1 and 8 is not rendered obvious by either of the Litvak reference, or the Chao reference, alone or in combination, and respectfully request the withdrawal of the rejection under 35 U.S.C. § 103(a).

Claims 2-7 and 9-15 depend from claims 1 and 8 respectively and are patentably distinct for at least the reasons set forth above with regard to claims 1 and 8. Therefore, Applicant respectfully contends that claims 2-7 and 9-15 are allowable over the cited references and respectfully request the withdrawal of the rejection under 35 U.S.C. § 103(a).

SUMMARY

In view of the foregoing amendments and remarks, Applicant respectfully submits that the pending claims are in condition for allowance. Applicant respectfully requests reconsideration of the application and allowance of the pending claims.

If the Examiner determines the prompt allowance of these claims could be facilitated by a telephone conference, the Examiner is invited to contact George B. Leavell at (408) 749-6900, ext 6923.

Deposit Account Authorization

Authorization is hereby given to charge our Deposit Account No. 50-0805 (Order No. LAM2P282) for any charges that may be due or credit our account for any overpayment. Furthermore, if an extension is required, then Applicant hereby requests such extension.

Respectfully submitted,

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